Claims

We claim:

1. A photonic component package, the package for coupling to at least two photonic elements and for mounting onto a module, the package comprising:

a package body and at least two pins, the at least two pins for insertion into the module, wherein the at least two pins each comprise a substantially straight section, and the at least two pins extend from the package body without increasing the footprint requirements of the package for mounting the package onto the module; and

the package body having a photonic inlet, the photonic inlet oriented parallel to a mounting surface of the module, and the photonic inlet for attaching to at least one photonic element.

2. The photonic component package of claim 1, wherein the package further comprises an interior, the interior for housing a semiconductor die, the semiconductor die comprising a planar side and a die photonic element, whereby the semiconductor die is attached to the package and a planar side of the die is positioned approximately orthogonal to the photonic inlet, and wherein the die photonic element is optically coupled with the at least one photonic element.

3. The photonic component package of claim 2, wherein the package body further comprises a pinout side, wherein the straight sections of the at least two pins are positioned substantially orthogonally from the pinout side.

4. The photonic component package of claim 2, wherein the photonic element is selected from the group consisting of a wave guide, a planar wave guide, a photonic crystal wave guide, a diffraction wave guide grating, an optical fiber, a collimator, a dual fiber collimator, a multi-fiber collimator, a lens, a diffractive lens, an optical lens, a spherical lens, an aspherical lens, a ball lens, a GRIN lens, a C-lens, a lens system, a mirror, a MEMS-based movable micro-mirror, a flat mirror, a shaped mirror, a diffractive mirror, a grating plate or plates, a laser, a modulator, a photodiode, a VCSEL, and a prism.

5. The photonic component package of claim 2, wherein the body comprises ceramic.

6. The photonic component package of claim 2, wherein the body comprises metal.

7. The photonic component package of claim 2, wherein the at least two pins are oriented to fit into a socket.

8. The photonic component package of claim 2, wherein the photonic component package is a low cost package.

9. The photonic component package of claim 2, wherein the package further comprises a through hole, the through hole coupled with the photonic inlet and the through hole positioned to allow optical coupling of the die photonic element and the at least one photonic element.

10. The photonic component package of claim 2, wherein the photonic component package further comprises a lid, and the package interior further comprises a cavity, and the lid coupled with the package body and substantially covering the cavity, whereby the semiconductor die is housed within a combination of the cavity and the lid.

11. The package of claim 2, wherein the semiconductor die comprises a laser.

12. The photonic component device package of claim 2, wherein the semiconductor die comprises a photodiode.

13. The photonic component package of claim 2, wherein the semiconductor die is comprised within a MEMS device.

14. The photonic component package of claim 13, wherein the MEMS device comprises a mirror, the mirror oriented to reflect light accepted from the through hole.

15. The photonic component package of claim 14, wherein the at least one photonic element is selected from the group consisting of a wave guide, a planar wave guide, a photonic crystal wave guide, a diffraction wave guide grating, an optical fiber, a collimator, a dual fiber collimator, a multi-fiber collimator, a lens, a diffractive lens, an optical lens, a spherical lens, an aspherical lens, a ball lens, a GRIN lens, a C-lens, a lens system, a mirror, a MEMS- based movable micro-mirror, a flat mirror, a shaped mirror, a diffractive mirror, a grating plate or plates, a laser, a modulator, a photodiode, a VCSEL, and a prism.

16. The photonic component package of claim 15, wherein the photonic component package is further coupled with a receiving photonic element, the receiving photonic element coupled with the photonic inlet and for receiving light from the semiconductor die and via the through hole.

17. The photonic component package of claim 16, wherein the receiving photonic element is selected from the group consisting of a wave guide, a planar wave guide, a photonic crystal wave guide, a diffraction wave guide grating, an optical fiber, a collimator, a dual fiber collimator, a multi-fiber collimator, a lens, a diffractive lens, an optical lens, a spherical lens, an aspherical lens, a ball lens, a GRIN lens, a C-lens, a lens system, a mirror, a MEMS-based movable micro-mirror, a flat mirror, a shaped mirror, a diffractive mirror, a grating plate or plates, a modulator, a photodiode, and a prism.

18. The photonic component package of claim 13, wherein the body comprises ceramic.

19. The photonic component package of claim 13, wherein the body comprises metal

20. The photonic component package of claim 14, wherein the mirror is movable in response to electrical signals applied to the MEMS device via at least one of the at least two pins, whereby the angle of reflection of the light from the MEMS is affected.

21. A photonic component package, the photonic component package for optically coupling an external photonic element and a die photonic element, and the photonic component package for mounting onto a module, the die photonic element comprised within a semiconductor die, the semiconductor die having a planar side and at least two electrical contact pads, the photonic component package comprising:

a package body, a lid, a photonic inlet, and at least two pins;

the package body having a pinout side and a cavity, the semiconductor die attached to the package body and the semiconductor die located within the cavity;

the lid coupled with the package body and enclosing the cavity;

a through hole extending through the photonic component package and providing a pathway for light between the die photonic element and the external photonic element;

the photonic inlet oriented parallel to a mounting surface of the module, and the photonic inlet for aligning and attaching the external photonic element;

wherein each of the at least two pins are coupled with the pinout side and are electrically coupled with the at least one of the at least two electrical contact pads of the semiconductor die, and each of the at least two pins are positioned approximately parallel with the planar side of the semiconductor die, and the at least two pins extending from the pinout side, wherein the projections of the at least two pins onto the pinout side are fully contained within the footprint of the package body; and

whereby the planar side of the semiconductor die is positioned approximately orthogonal to the photonic inlet, and light may pass between the die photonic element and the external photonic element via the through hole.

22. The photonic component package of claim 21, wherein the at least two pins are oriented to fit into a socket.

23. The photonic component package of claim 21, wherein the photonic component package is a low cost package.

24. The photonic component package of claim 21, wherein the photonic component package further comprises at least three pins coupled to and extending from the pinout side and the at least three pins are electrically coupled with the semiconductor die.

25. The photonic component package of claim 21, wherein the body comprises ceramic.

26. The photonic component package of claim 21, wherein the body comprises metal.

27. The photonic component package of claim 21, wherein the die photonic element is a laser.

28. The photonic component device package of claim 21, wherein the die photonic element is a photodiode.

29. The photonic component package of claim 21, wherein the semiconductor die is comprised within a MEMS device.

30. The photonic component package of claim 29, wherein the MEMS device comprises a mirror, the mirror oriented to reflect light accepted from the through hole.

31. The photonic component package of claim 21, wherein the photonic inlet is coupled with an emitting photonic element, the emitting photonic element for emitting

light via the through hole and toward the semiconductor die, and the photonic inlet for maintaining an alignment of the emitting photonic element and the semiconductor die.

32. The photonic component package of claim 31, wherein the emitting photonic element is selected from the group consisting of a wave guide, a planar wave guide, a photonic crystal wave guide, a diffraction wave guide grating, an optical fiber, a collimator, a dual fiber collimator, a multi-fiber collimator, a lens, a diffractive lens, an optical lens, a spherical lens, an aspherical lens, a ball lens, a GRIN lens, a C-lens, a lens system, a mirror, a MEMS-based movable micro-mirror, a flat mirror, a shaped mirror, a diffractive mirror, a grating plate or plates, a laser, a modulator, a photodiode, a VCSEL, and a prism.

33. The photonic component package of claim 21, wherein the photonic inlet is further coupled with a receiving photonic element, the receiving photonic element for receiving light from the die photonic element and via the through hole.

34. The photonic component package of claim 33, wherein the receiving photonic element is selected from the group consisting of a wave guide, a planar wave guide, a photonic crystal wave guide, a diffraction wave guide grating, an optical fiber, a collimator, a dual fiber collimator, a multi-fiber collimator, a lens, a diffractive lens, an optical lens, a spherical lens, an aspherical lens, a ball lens, a GRIN lens, a C-lens, a lens system, a mirror, a MEMS-based movable micro-mirror, a flat mirror, a shaped mirror, a

diffractive mirror, a grating plate or plates, a laser, a modulator, a photodiode, a VCSEL, and a prism.

35. The photonic component package of claim 33, wherein the photonic inlet is further coupled with an emitting photonic element, the emitting photonic element for emitting light to the die photonic element and via the through hole.

36. The photonic component package of claim 29, wherein the body comprises ceramic.

37. The photonic component package of claim 29, wherein the body comprises metal.

38. The photonic component package of claim 29, wherein the die photonic element is a laser.

39. The photonic component package of claim 29, wherein the die photonic element is a photodiode.

40. The photonic component package of claim 29, wherein the MEMS device comprises a mirror, the mirror oriented to reflect light via the through hole.

41. The photonic component package of claim 40, wherein the mirror is movable in response to electrical signals conducted to the MEMS device via at least one of the at

least two pins, whereby the angle of reflection of the light from the MEMS device is affected.

42. A VOA package, the VOA package for attachment to a mounting surface of a module, and the VOA package for enclosing a semiconductor die, the semiconductor die comprising or coupled with a movable mirror, and the semiconductor die having two planar sides, at least two electrical contact pads and the semiconductor die further comprises or is coupled with the movable mirror, and the VOA package coupled with a collimator, the collimator for positioning at least two optical fibers, the VOA package comprising:

a package body, a lid, a photonic inlet, and at least two pins;

the package body having a pinout side, a photonic inlet side and a cavity;

the photonic inlet attached to the photonic inlet side of the package, and the photonic inlet for attaching the collimator and positioning the optical fibers to be parallel to the mounting surface of the module;

the through hole extending through the VOA package and to the cavity, and the through hole for enabling light to pass between the movable mirror and the at least two optical fibers;

each of the at least two pins coupled with the pinout side and electrically coupled with the semiconductor die, and the at least two pins extending from the pinout side;

the lid coupled with the body and enclosing the cavity; and

whereby the semiconductor die is attached to the body and within cavity, and the mirror of the semiconductor die is positioned to variably optically attenuate an optical signal emitted from at least one of the at least two optical fibers through a collimator lens by controllably redirecting the optical signal reflected from the mirror and going back through the collimator lens to the other optical fiber.

43. The VOA package of claim 42, wherein the at least two pins are oriented to fit into a socket.

44. The VOA package of claim 42, wherein the photonic component package is a low cost package.

45. The photonic component package of claim 43, wherein the photonic component package further comprises at least three pins coupled to and extending from the pinout side and the at least three pins electrically coupled with the semiconductor die.

46. The VOA package of claim 42, wherein the body comprises ceramic.

47. The VOA package of claim 42, wherein the body comprises metal

48. The VOA package of claim 42, wherein the semiconductor die is comprised within a MEMS device.

49. The photonic component package of claim 1, wherein the package further comprises a boot, the boot for at least partially enclosing the photonic inlet, the boot comprising:

a base, an upper wall, a boot opening, and a boot hole, wherein the boot opening enables at least partial insertion of the photonic element into the boot, and light may pass between the photonic element and the semiconductor die and through the boot hole;

the base is substantially planar and is positioned to make mechanical contact with a surface of a module when the photonic component package is mechanically coupled with the module; and

the upper wall is coupled with the base, and the upper wall and base in combination house the photonic inlet.

50. The photonic component package of claim 49, wherein the upper wall of the boot further comprises three substantially planar surfaces, wherein a first substantially planar

surface is substantially parallel with the base, and a second and a third substantially planar surfaces are both substantially perpendicular to the base.

51. A method of packaging a photonic component, comprising:

providing an external photonic element;

providing a semiconductor die, the semiconductor die having a planar side, at least two electrical contact pads, and a die photonic element;

providing a package, the package having a package body, at least two pins, a lid, a through hole, and a photonic inlet;

the package body having a pinout side and a cavity;

the at least two pins extending from the pinout side of the package body, and wherein the projections of the at least two pins onto the pinout side are fully contained within the footprint of the package body;

the lid for attachment to the package body and for enclosing the cavity;

the through hole for providing a pathway for light through the package and between the external photonic element and the die photonic element;

the photonic inlet oriented parallel to a mounting surface of a module, and the photonic inlet for aligning and attaching the external photonic element;

attaching the semiconductor die to the package body and within the cavity, and in an orientation wherein the planar side of the semiconductor die is approximately orthogonal to the photonic inlet;

bonding of at least one wire to at least one pin and to one of the at least two electrical contact pads;

attaching the lid to the package body and enclosing the cavity;

aligning the external photonic element relative to the through hole and the die photonic element to optically couple the external photonic element and the die photonic element; and

attaching the external photonic element to the photonic inlet in a optically coupled alignment, whereby the semiconductor die is positioned approximately orthogonal to the external photonic element, and the die photonic element and the external photonic element are optically coupled via the through hole.

52. The method of claim 51, wherein the package is a low cost package.

53. The method of claim 51, wherein standard die attach equipment attaches the semiconductor die to the package body.

54. The method of claim 51, wherein the wire bonds are formed using standard wire bond equipment.

55. The method of claim 51, wherein the package is assembled with standard packaging equipment.

56. The method of claim 51, wherein the lid is attached to the body package with standard lid attachment equipment.

57. The method of claim 51, wherein the package is marked with standard semiconductor device marking equipment.

58. The method of claim 51, wherein the photonic component is tested using standard test equipment.

59. The method of claim 51, further comprising providing a module and mounting the device onto the module using standard mounting equipment.

60. The method of claim 51, wherein the package substantially complies with a suitable package standard known in the art.